Remarks

Claims 1, 2 and 4-9 are pending in the application. Claims 1, 2, 4-9 are rejected. All rejections and objections are respectfully traversed. Claim 3 has been entered as canceled, and claim 4 has been amended to depend on claim 2. Claims 10-18 are new.

Claims 1, 2, 4-9 are rejected under 35 U.S.C. 101 as being directed to non-statuary subject matter. Claimed is a computer implemented method that acquires real-world non-stationary signals, such as acoustic signals or videos. The method produces characteristic and temporal profiles of the non-stationary signal.

With respect to claim 1, a non-stationary signal is acquired and a non-negative matrix of the non-stationary signal is constructed using features in the signal. The matrix includes columns representing features of the non-stationary signal at different instances in time. The non-negative matrix is factored to produce characteristic profiles and temporal profiles.

Components in the acquired non-stationary signal can be detected according to the characteristic profiles and temporal profiles. If the acquired signal is an acoustic signal, then the detected components can be phonemes in the case of speech, or notes in the case of music. If the signal is a video, the components can be moving objects in the video, and object can be detected, recognized or tracked.

According to M.P.E.P 2106, "For the purposes of an eligibility analysis, a physical transformation "is not an invariable requirement, but merely one example of how a mathematical algorithm [or law of nature] may bring about a useful application." AT&T, 172 F.3d at 1358-59, 50 USPQ2d at 1452. *The focus is not on whether the steps taken to achieve a particular result are useful, tangible, and concrete, but rather on whether the final result achieved by the claimed invention is "useful, tangible, and concrete."*

It is clear that the Examiner has only focused on the "mathematical calculation of signal representative matrices," that is, the constructing step, and none of the other limitations in the claim. There can be no doubt that the ability to analyze signals and detect components in the signals is a useful, concrete and tangible result.

Claimed is a computer-related process that physically transforms something that exists outside of the computer, the non-stationary signal, and produces characteristic and temporal components that are used to detect components of the signal. The method is limited to a practical application in the technological arts.

The physical transformation of signals is a safe harbor for processes that manipulate data representing physical objects or activities (pre-computer process activity). Claimed is acquiring a signal. The claimed process causes a physical transformation of the signals when characteristic and temporal profiles of the non-stationary signal are produced. The profiles are useful, tangible and concrete results for practical applications, such as speech or object recognition.

5. Claims 1,2,4-9 are rejected under 35 U.S.C. 102(b) as being anticipated by Saul(6401064).

The Examiner states that Saul describes the claimed non-negative matrices:

> As per claims 1,5,6,7 Saul (6401064) teaches a method for detecting a non-stationary signal by acquiring the signal (as non-stationary signals representative consonants –col. 1 lines 45-49; and in multidimensional space – col. 1 lines 35-40); constructing a non-negative matrix including columns representing features of the non-stationary signal at different instances of time (col. 3 line 65 – col. 4 line 5; including temporal information – col. 6 lines 10-20).

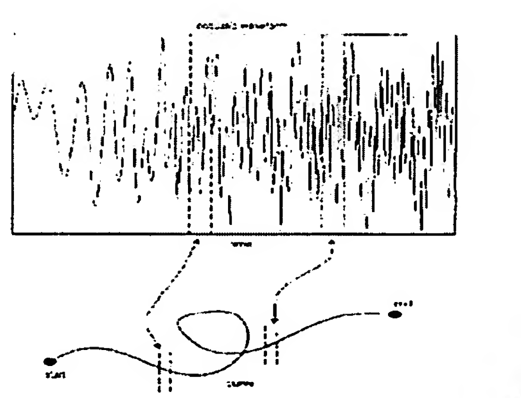
First the claimed method does not detect a non-stationary signal as stated by the Examiner. In his rejection, the Examiner only considers the constructing step, see above. The Examiner does not state where Saul performs the other claimed limitations, such as factoring the non-negative matrix into characteristic profiles and temporal profiles; and detecting components in the acquired non-stationary signal according to the characteristic profiles and temporal profiles. In fact, Saul does not describe any of these limitations.

According to M.P.E.P 2131 Anticipation, ""A claim is anticipated only if *each and every element* as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989)."

Saul does not describe the constructing a non-negative matrix of the non-stationary signal, the matrix including columns representing features of the non-stationary signal at different instances in time; and factoring the non-negative matrix into characteristic profiles and temporal profiles; and producing the characteristic profiles and temporal profiles.

Furthermore, the Saul method does not operate on non-negative matrices. Instead, Saul operates on Markov process curves (MPC), "A method and apparatus for speech recognition using *Markov processes on curves* are presented. The method and apparatus operate such that *input speech utterances are received and represented as multidimensional curves*. The *curve is split into acoustic segments* representing different components based on initial model estimates. The *segments are used to create a new statistical model for the curve*." The MPCs are initialized using Hidden Markov Models. Saul is non-analogous art.

Saul



Non-negative matrix factorization (NMF) is a group of algorithms in multivariate analysis and linear algebra where a matrix, **X**, is factorized into

two matrices, **W and H** NMF (X) $\rightarrow$ **WH.** The rejection of claim 1 based on anticipation is, with all due respect, wrong.

The Examiner summarily rejects claims 2, 4, 8, and 9 as follows.

> **As per claims 2,4,8,9, <u>Saul (6401064)</u> teaches M total of bins/slots along with an RxM matrix (col. 4 lines 4-25,col. 4 lines 30-34, col. 4 lines 42-67; col. 6 lines 22-47).**

With respect to claim 2, claimed is a non-negative matrix that has M temporally ordered columns where M is a total number of histogram bins into which the features are accumulated, such that $M = (L/2+1)$, for a signal of length L.

The examiner cites column 4:

4

over $x \in \mathbb{R}^D$. If g(x) is everywhere non-negative definite, then it can be used as a metric to compute distances along curves. In particular, consider two nearby points separated by the infinitesimal vector dx. The squared distance between these two points is defined as:

$$dl^2 = dx^T g(x)\, dx. \qquad (1)$$

Arc length along a curve is the non-decreasing function computed by integrating these local distances. Thus, for the

For anticipation Saul must describe "*temporally ordered columns* where M is *a total number of histogram bins* into which the features are accumulated, such that M = (L/2+1), for a signal of length L." These elements are not described by Saul. There is no anticipation

With respect to claim 4, claimed is the non-negative matrix which is expressed as $\mathrm{R}^{M\times N}$, the temporal profiles are expressed as $\mathrm{R}^{M\times R}$ and the characteristic profiles are expressed as $\mathrm{R}^{R\times N}$, where $R \leq M$, where R is a

number of components to be detected.

Saul describes:

> non-Euclidean metric for computing arc lengths. Thus, for example, if the metric $g(x)$ varies as a function of x, then eq. (2) can assign different arc lengths to the trajectories $x(t)$ and $x(t)+x_0$, where x_0 is a constant displacement.

Saul does not describe temporal and characteristic profiles obtained by factoring a non-negative matrix. Instead, Saul describes arc lengths of Markov process curves.

With respect to claim 8 and 9, Saul describes:

$$\Pr[s|x] = \prod_{k=1}^{n} \lambda_{s_k} e^{-\lambda_{s_k} \ell_k} \sum_{k=0}^{n} a_{s_k s_{k+1}} \qquad (5)$$

> where we have used s_0 and s_n+1 to denote the START and END states of the Markov process. The first product in eq. (5) multiplies the probabilities that each segment traverses exactly its observed arc length. The second product multiplies the probabilities for transitions between states s_k and s_{k+1}. The leading factors of λ_{s_k} are included to normalize each state's duration model.
>
> There are many important quantities that can be computed from the distribution, $\Pr[s|x]$. Of particular interest for ASR is the most probable segmentation: $s^*(x)=\mathrm{argmax}_s\{\ln \Pr[s|k]\}$. This maximization can be performed by discretizing the time axis and applying a dynamic programming procedure.
>
> The parameters $\{\lambda_i, a_{ij}, g_i(x)\}$ in MPCs are estimated from training data to maximize the log-likelihood of target segmentations. In our preliminary experiments with MPCs, we estimated only the metric parameters, $g_i(x)$; the others were assigned the default values $\lambda_i=1$ and $a_{ij}=1/f_i$, where f_i is the fanout of state i. The metrics $g_i(x)$ were assumed to have the parameterized form:

As best can be determined, Saul describes probabilities of MPCs. Not components of a signal as claimed.

But for the 35 U.S.C. 110, claims rejection, claims 4-7 have not been examined.

It is believed that this application is now in condition for allowance. A notice to this effect is respectfully requested. Should further questions arise concerning this application, the Examiner is invited to call Applicants' attorney at the number listed below. Please charge any shortage in fees due in connection with the filing of this paper to Deposit Account 50-0749.

Respectfully submitted,
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